



National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

**FACILITY OPERATION PROCEDURE
FOR
THERMAL VACUUM CHAMBER V-10**

**ENVIRONMENTAL TEST FACILITY
THERMAL AND FLUID SYSTEMS GROUP
STRUCTURES, MECHANICS, AND THERMAL DEPARTMENT
ENGINEERING DIRECTORATE**

THIS PROCEDURE DOES NOT CONTAIN HAZARDOUS OPERATION

**CHECK THE MASTER LIST—
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE**

**FACILITY OPERATION PROCEDURE
FOR
THERMAL VACUUM CHAMBER V-10**

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1.0 GENERAL INFORMATION

1.1 PURPOSE

This document describes the procedures for the operation of Thermal Vacuum Chamber V10 located in MSFC Building 4619, Room 167B.

1.2 SCOPE

The procedures and practices outlined in this document are to be followed in the operation of chamber V10. This document provides a record copy of chamber V10 operations.

1.3 APPLICABLE DOCUMENTS

NPG 8715.3	NASA Safety Manual
MPG 8715.1	Marshall Safety, Health, and Environmental (SHE) Program
MPG 8730.5	Control of Inspection, Measuring, and Test Equipment
MSOP-FA-413	Control of Hazardous Energy (Lockout/Tagout) Procedure for the Environmental Test Facility
MFOP-FA-ETF-426	Unattended Operation of the Environmental Test Laboratory
ED26-OWI-ETF-001	Environmental Test Facility Test Program Control
ED26-OWI-ETF-002	Environmental Test Facility (ETF) Test Operations

1.4 SAFETY

All test personnel working in this facility shall be familiar with the safety documents listed above, and shall report any safety hazards or unsafe practices to the ETF Team Leader or the 4619 Building Manager Assistant.

All personnel involved in facilities using cryogenics should be aware of possible freezer burns by contact with cold surfaces or liquids. All personnel involved in handling of cryogenics or when making repairs/modification to cryogenic facilities must wear protective clothing including face shields and gloves. In the event of a cryogenics spill, line ruptures, or similar emergencies, personnel must first be sure that there is no possibility of asphyxiation due to oxygen displacement. Use a portable oxygen monitor to verify oxygen is adequate before entering the area.

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1.5 EMERGENCY TELEPHONE NUMBERS

Dial **911** for all emergencies, including:

Medical	911
Fire	911
Ambulance	911
Security	911
Chemical Spills	911

Other number that can be used to obtain information about emergency, security, safety, and utilities are:

Medical Center	544-2390
Security	544-4357
Safety	544-0046
Utilities	544-3919
Other Assistance	544-4357 (4-HELP)

1.6 HAZARDS LIST

- 208 and 120 volts AC electrical power
- Extreme temperatures in the chamber (hot and cold)
- Vacuum pump oil

*******WARNING*******

Prior to performing maintenance on any equipment, lockout and tag the equipment in accordance with Lockout/Tagout Procedure MSOP-FA-413. Maintenance shall be performed by qualified technicians only.

1.6.1 Minimizing Electrical Shock Hazards

- 1.6.1.1 All electrical repairs and modification shall be performed by electrical technicians to minimize the electrical shock hazard.
- 1.6.1.2 All bare electrical parts inside the chamber with a potential to ground of 50 volts or greater should remain de-energized when the chamber is open. If this is infeasible, then safety related work practices shall be employed to prevent electrical shock. The safety related work practices shall be documented and approved by a senior ETF electrical engineer. All work near energized bare electrical parts shall be performed by qualified persons.
- 1.6.1.3 Personnel must not reach into a chamber with energized bare electrical parts where there is a lack of illumination or an obstruction of view. Personnel

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- must never blindly reach into an area that may contain energized bare electrical parts.
- 1.6.1.4 Personnel shall remove all conductive apparel before working near energized bare electrical parts, including jewelry, watches, key chains, metalized aprons, and metal head gear.
 - 1.6.1.5 Only a senior ETF electrical engineer may defeat an electrical safety interlock and then only temporality while the work is being performed. The interlock shall be returned to its operable condition when the work is completed.
 - 1.6.1.6 Personnel may not perform housekeeping duties at close distances to energized bare electrical parts unless adequate safeguards are provided. Only non-conductive cleaning materials shall be used.
 - 1.6.1.7 Personnel working near bare electrical parts energized at 50 volts or greater shall be provided protective equipment adequate to insulate the potential shock hazard. Personnel shall use insulating tools near energized bare electrical parts.
 - 1.6.1.8 Safety signs or tags shall be used to warn personnel that electrical shock hazard is present when there are bare electrical parts energized at 50 volts or greater.
 - 1.6.1.9 Barricade shall be used in conjunction with signs or tags to limit personnel access.
 - 1.6.1.10 Any de-energized electrical parts that are not locked-out, tagged-out, or unplugged will be considered energized. If tag-out is the method used, two or more isolation switches shall be opened. Any bare electrical part that is energized at less than 50 volts to ground need not be locked-out or tagged-out provided there is no risk of burns or arcing.
 - 1.6.1.11 All live electrical parts located outside the chamber and energized at 50 volts or greater must be guarded against accidental contact. Guarding methods include approved enclosures or permanent partitions or screens that restrict access by non-qualified personnel.
 - 1.6.1.12 Personnel shall not handle, energize or de-energize, plug-in or unplug any electrical device when the device is wet, the employee is wet, or the floor is wet.
 - 1.6.1.13 Locking type connectors shall be properly secured after connection.
 - 1.6.1.14 After a circuit has been de-energized by the opening of a protective device, the circuit shall be inspected by an ETF electrical technician before the circuit is re-energized.
 - 1.6.1.15 Over-current protective devices shall not be modified.

*******WARNING*******

Prior to performing maintenance on any equipment, lockout and tag the equipment in accordance with Lockout/Tagout Procedure MSOP-FA-413. Maintenance shall be performed by qualified technicians only.

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1.6.2 Minimizing Vacuum Oil Hazards

The vacuum pump oil can cause skin irritation. Avoid skin contact with the oil. Remove this oil from the skin using soap and water. Wear safety glasses while adding or changing oil. Remove oil from the eyes by flushing with water for 15 minutes. Avoid breathing vacuum oil mist.

2.0 FACILITY DESCRIPTION

2.1 CHAMBER DESCRIPTION AND DIMENSIONS

Chamber V10 is a stainless steel cylindrical vessel with polished interior surfaces. The inside dimensions are 18" diameter and 18" height.

2.2 VACUUM SYSTEM

The vacuum system consists of a mechanical roughing pump, an ion pump, and a hand valve to isolate the chamber from the roughing pump.

2.3 CONTROL SYSTEM

The control system consists of switches for operating the ion pump and heaters. The mechanical pump is controlled by plugging-in or unplugging its 120 volt power receptacle. Pressure monitoring is by convectron and ion gauges. The only valve is a roughing line hand valve.

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3.0 FACILITY OPERATION

Complete the As-run Buy-off Sheet when operating the chamber. This sheet is typical provided with the TPS. If none is provided, use a copy of Attachment A.

3.1 FACILITY PREPARATION

3.1.1 Ensure that all connections to the chamber are compatible with proper operation of the chamber. Determine that the test is ready to start.

3.1.2 Verify that all instrumentation to be used on the test has current calibration labels where applicable.

*******WARNING*******
Prior to performing maintenance on any equipment, lockout and tag the equipment in accordance with Lockout/Tagout Procedure MSOP-FA-413. Maintenance shall be performed by qualified technicians only.

3.2 VACUUM SYSTEM OPERATION

3.2.1 Seal the lid to chamber.

3.2.2 **CLOSE** the roughing line hand valve.

3.2.3 Turn **ON** the mechanical roughing pump by plugging-in it's 120 volt power receptacle. Visually inspect the level and condition of the roughing pump oil (center of the sight glass is the correct level). Add or change oil as needed. Change the oil whenever it is darkened, contaminated, milky, or if the pump performance has degraded.

3.2.4 Allow the mechanical pump to rough pump its inlet pipe.

3.2.5 Switch **ON** the gauge controller and ensure the convectron gauge is operating.

3.2.6 **OPEN** the roughing line valve.

3.2.7 Allow the chamber to rough pump to 10 millitorr or less, as indicated on the convectron gauge.

3.2.8 Switch the meter range on the ion pump power unit to 2A.

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- 3.2.9 When pressure reaches the 10 millitorr or less, switch **ON** the ion pump. If the ion pump starts pumping, close the roughing valves. If the ion pump does not start pumping within three minutes, switch it off and allow 30 minutes for the ion elements to cool. Repeat this step until the pumps start or it is determined there has been a failure.
- 3.2.10 When the pressure reaches the E -4 torr range, CLOSE the roughing line valve and switch **OFF** the roughing pumps by unplugging its' power receptacle.
- 3.2.11 When pressure reaches the E -4 torr range, switch **ON** the ion gauge at the gauge controller. If it switches itself off, wait a minute and re-try switching it ON.
- 3.2.12 Adjust the meter range to a lower amperage range on the ion pump power unit so that the indication needle is on scale and not pegging the meter. Several adjustments may be need before the pressure stabilizes.

3.3 UNATTENDED OPERATION

The thermal vacuum chamber is designed for continuous automatic operation. To preclude inadvertent automatic shutdown of the chamber or anomalies in the test environment and/or test data, complete the following steps before leaving the operating equipment unattended.

- 3.3.1 Verify that all facility expendable sources will be available for the unattended period.
- 3.3.2 Complete applicable sections of the procedure MFOP-FA-ETF-426, Unattended Operation of the Environmental Test Laboratory.

3.4 VACUUM SYSTEM SHUTDOWN

- 3.4.1. Switch **OFF** the heaters on the ion pump power unit.
- 3.4.2. Switch **OFF** the ion pump power unit.
- 3.4.3. Once the pressure reaches the 1 torr range, **OPEN** the roughing line valve.
- 3.4.4. Remove dome after the chamber reaches ambient pressure.

4.0 EMERGENCY SHUTDOWN

- 4.1 Shut down unit by switching **OFF BREAKER 4** in **Power Panel PP** located on the south wall near V2 just east of Column 8.

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- 4.2 Shut off roughing pump by unplugging its' power receptacle.
- 4.3 Vent the chamber and remove test article only when there is no risk of injury to personnel.

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V10 As-run Buy-off Sheet

Test Number _____ Customer Contact _____

Calling TPS or Work Instructions _____ Start Time & Date _____

Test Description _____ End Time & Date _____

Test Operator(s) (Print name and initial) _____

Initial each step once completed. If test exceeds one day, date the first step each new day.

3.1 Facility Preparation 3.2.12 _____

3.1.1 _____

3.1.2 _____

3.3 Unattended Operation

NA if not required

3.3.1 _____

3.3.2 _____

3.2 Vacuum Sys. Oper.

3.2.1 _____

3.2.2 _____

3.2.3 _____

3.2.4 _____

3.2.5 _____

3.2.6 _____

3.2.7 _____

3.2.8 _____

3.2.9 _____

3.2.10 _____

3.2.11 _____

**3.4 Vacuum System
Shutdown**

3.4.1 _____

3.4.2 _____

3.4.3 _____

3.4.4 _____

QA _____

NA if not required